DRAFT
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SUMMARY AND CONCLUSIONS

1. The strategic military importance of boron compounds, because of their high energy yield, has been demonstrated by the U. S. Armed Forces.

2. The military uses to which the boron compounds will be put cannot be determined until current research and development efforts are culminated. Statistical requirements cannot be firmly established.

3. The export of boron-containing substances even in small quantities to the Sino-Soviet Bloc is detrimental to the National Defense. The quantity of boron compounds available will dictate the extent of their use by the USSR.

THE MILITARY IMPORTANCE OF BORON COMPOUNDS

The military and strategic importance of the boron compounds lies in their value as high energy substances. Upon oxidation, a boron hydride releases 50% more energy than a similar weight of a hydrocarbone fuel. This added energy is of extreme importance to military engineers since it can be translated into the superior performance so urgently needed in modern warfare. To obtain this 50% additional energy, an increase in cost of 150 times that of conventional fuels is justified. This, combined with other combustion characteristics, such as inflammability limits, make the boron compounds strategically important for use in specialized weapons, guided missiles and aircraft. When produced in quantity, the cost of boron compounds will be cut sharply.

THE U.S. RESEARCH AND DEVELOPMENT

The defense establishment is vigorously conducting a comprehensive program to develop practical uses for the boron compounds. This research is slowed by the relative newness and complexity of this special field of chemistry. Some investigations have reached experimental levels and field trials have demonstrated remarkable performances. For example, one ramjet test model using a boron compound additive has reached a speed in excess of 2500 miles per hour.

There are numerous ways in which the boron compounds can be used in the National Defense. The following are several applications which have been suggested:

(1) High energy rocket fuels. A comparisson of performance figures shows that some boron compounds yield higher energies than hydrazine, ammonia, gasoline, and alcohol. Significantly, these boron compounds have wide temperature ranges in the liquid phase which correspond to those desired for rocket fuels.

(2) Rocket Fuel Additives: The use of hydrazine, favorably considered as a rocket fuel both in this country and abroad, is hampered by a high melting point. Recent research, however, has shown that at least two boron compounds, in low concentrations, will provide satisfactory properties and at the same time will maintain and even increase the hydrazine performance.

(3) Ramjet Fuel Additive. At least two boron compounds will prevent the flame blowout encountered in ram jet engines. One compound in as low as a 3% concentration will render hydrocarbons spontaneously inflammable in air. The second compound, in equally small concentrations, will increase the flame speed of ethane by sixteen fold.

(4) Water reactive fuels. Several boron compounds have come into prominence as water reactive chemicals. As such, they may be used to advantage in increasing the speed of water-borne vehicles such as torpedoes.

(5) Gas generating reagents. There is a frequent need in rocket technology to pressurize fuel tanks. Favorable performance has been reported when boron compounds are used.

The successful use of boron compounds for the purposes envisioned by the defense establishment awaits the completion of current research and development efforts. The boron compounds have potential value. They can and will be used in National Defense.

THE SOVIET INTEREST IN BORON COMPOUNDS

The high energy value of boron compounds is known thoughout the world. The USSR is aware of their strategic value and its chemists and engineers are qualified and competent to engage in difficult boron research and development. That current research is in progress has been reported by both returning German scientists and the current technical literature.

The statistical requirements of the Soviet Union for boron compounds cannot be established since these would conjecture the intended end uses. But, it is known that the USSR does have boron resources and facilities for processing the minerals. Also known is the high regard which the USSR holds for its boron wealth. This is demonstrated by the Soviet determination to circumvent Western restrictions on the movement of boron compounds and its refusal to assist in the shortage being experienced by the East German ceramics industry.

The strategic military significance of the high energy yield of the boron compounds alone dictates the necessity to restrict their export to countries of the Sino-Soviet Bloc. That even small quantities of these compounds can be used advantageously by the Bloc is signified by their possible restricted use in specialized weapons only. The export of all boron-containing substances is harmful because the importance which the USSR places upon its end use items is undeterminable.

FOREIGN ACTIVITIES

The only countries that can be expected to engage in boron studies are those capable of conducting lengthy and complex chemical investigations. Besides the U. S. and the USSR, only Great Britain and Germany possess such capabilities. Both of these countries are engaged in such research. That the British interest follows along similar lines as the American is demonstrated in at least ten military reports published during the past decade. This work continues.

During the occupation, Germany research had to be non-military. Nevertheless, the basically academic or fundamental work performed will be conducive to activities along the more practical lines when such opportunities return.

Although lesser capabilities may exist in countries such as Canada, France, Italy, and others, it is to be acknowledged that if military interest is engendered, then such countries would soon profit by the hundreds of boron research reports being published annually.